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X4A9.1/106

RECOMMENDATION FOR KEYBOARD ARRANGEMENT TO IMPLEMENT ASCII.

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The action taken at the April 20-21, 1966 meeting of Working Group X4A9.1, in which each member has been requested to submit a keyboard arrangement at the next meeting, has caused me to reflect over the previous actions of X4A9.1 and other groups that are working on keyboard arrangements. Each member, as a technically responsible member, now must ask himself if it is advantageous and/or desirable to have an "ASCII Keyboard Arrangement" and if the answer is yes, what should be incorporated in such a standard.

I am sure that we all realize that any standard that the Working Group proposes would have broad and long lasting implications. Each of us must relate proposed arrangements to known, current situations. We also need to project any and all arrangements toward future applications to the best of our abilities. Such projections of course can only be best guesses at the current time with the information available. However, without attempting to define any specific device, there is no question in my mind that the use of a coded keyboard arrangement will increase rather rapidly in the next several years. The common problem of the Working Group is how to develop an arrangement which satisfies present and future requirements of both manufacturers and users.

As a part of this enforced reflection we must review the Working Groups original stated criteria as well as additional considerations which have been expressed by members of the Working Group and others.

In attempting to apply the proposed standard across broad product and application lines, we have been faced with conflicting requirements. In many cases conflict has arisen over placement and assignment of Control Keys. In order to circumvent this problem, suggestions have been made to develop families of Keyboard Standards. On the surface this may appear to be the answer to the problem, however, we must recognize that families have a natural tendency to multiply, which could create an ever growing number of standards. I believe that any condition which allows or encourages an infinite number of standards is much worse than no standard at all.

The challange before us is to develop a single standard whose greatest value will be when it is used as a "Tool" to apply in designing equipment and arrangements for specific requirements. Equipment manufacturers are in a good position to specify and evaluate controls that are required for specific devices and applications. Therefore, I suggest that we do <u>not</u> attempt to locate or specify single purpose coded control keys. This means that to be complete, the standard will provide triple coded keys.

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The third or Control shift would be capable of developing the control code. but this method would be applied only for low useage controls. Where the device and application requires frequent or high useage control keys the designer is free to assign and locate these keys outside the "Standard" area to best meet the Human Factors requirements as applied to a particular device or application. This arrangement also will provide for the maximum acceptability for International arrangements that may desire to place high useage national option alpha or graphics to the right of the assigned or "Standard" area.

In considering key tip pairings, I feel that these requirements must be made with the one bit difference rule being observed. Three major reasons are to be considered. The first is that to do otherwise would present restrictions on some of the current devices using code bar type of mechanism with simple inversion means which may or may not be capable of accommodating inversion of two, three or more bits. Secondly from observing trends in the International area the single bit rule has the greatest favor. The third reason is from the code table itself, a single bit inversion is enforced on lower and upper case Alpha characters and to follow the single bit inversion rule in other areas would provide consistency throughout. This means that some of the graphics assigned above the row numerics will not agree with either the manual or electric Typewriter Standard. Since relatively few operators develop touch operation of these graphics, this problem should not be insurmountable. In any event the negative transfer will be no worse than currently exists when an operator changes from a manual to electric typewriter.

In our review at NCR to establish our recommended arrangement, we essentially retraced many of the steps that X4A9.1 has taken in nearly two years of work. We started with the arrangement shown in Fig. 1 which includes the twenty-six Alpha characters, the ten numerics and the Space bar. This 4 row arrangement is an absolute minimum Mono-case arrangement. The assignment of these thirty-six keys, plus Space, could be considered as a minimum area of Standardization which could not be altered or negotiated. Further code assignments are based on the latest proposed table, X3.2/384.

In Fig. 2, twelve coded keys have been added to accommodate code requirements of Columns 2-3-4 & 5 of the ASCII Code Table. In making these assignments the graphics have been paired with the row numerics and three non coded keys (Shift and Shift Lock) have been added to provide a means to access the shifted codes.

The comma, period and slash, question mark have been placed to correspond to typewriter standard, the greater than and less than have been paired using the single bit rule. Semi-colon and plus, and colon and asterisk have been assigned to keys 54 and 55 respectively. In assigning a graphic to key 55 reference is made to document X4A9.1/3 which shows 96 International typewriter keyboard arrangements that are representative of the stated countries, according to Remington Rand. In all 96 arrangements, Key 55 is a graphic. It should also be noted that in 39 of the examples, graphics are also assigned to Key 56. The manual and electric standards also provide Key 55 as a graphic position when the arrangements are expanded to 46 keys. (See also X4A9.1/99)

Single purpose graphics have been assigned to keys 3, 4, 16, 17, 18 and 35. Key 15 is a code inversion in order to place the hyphen in the unshifted position (as per T.W. Std.) The opening bracket has been assigned to key 17, and the closing bracket to key 18. This was done to group together like graphics and is similar to the adjacent key assignment of the parenthesis.

Fig. 3 is our 96 code recommendation (Similar to the 4th draft) but has added the Shift, Shift Lock and Delete.

In Fig. 4 the full 128 codes have been assigned with the two code columns of controls assuming a third shift position. Key 64 (Control) is shown to provide means to access these codes. The heavy black lines which frame the coded area are to indicate the area of maximum standardization and the area outside is defined as "unassigned". In this complete arrangement a <u>minimum</u> number of keys have been used. The "unassigned" area provides for variations in specific devices and also provides freedom to assign high useage national option graphics for International use.

RECOMMENDATION FOR ASCII KEYBOARD STANDARD.

N.C.R.'s present position regarding the standard keyboard arrangement to implement ASCII is that we support an arrangement as shown in Fig. 4 which does not assign or specify the arrangement or placement of single purpose control or function keys. We feel that such an arrangement can be the means to provide the largest degree of standardization on central or core assignments but allow the greatest flexibility in meeting the many and varied specific application requirements. The need for block numerics as a part of some of these applications is acknowledged but we do not feel that the arrangement or placement should be a part of this standard as this has already been covered by the Adding Machine Group. This would in no way make non-standard an arrangement which would have all or part of the 48 key Alpha-numeric arrangement and a 10 key numeric arrangement adjacent to it. The standard should neither specify nor limit the placement of single purpose control or function keys outside the area outlined in Fig. 4. Considerations of the standard should include sufficient flexibility to permit the substitution of single purpose control keys in arrangements that do not require the use of all keys in the 'standard area'. (Example: If keys 3 and 4 are not required it would be acceptable to place BS as a single purpose control, in key 4 position.) This flexibility needs to be broad enough to include at least keys 3, 4, 17 and 18 as these keys represent some of the current low useage graphics. The exact means to provide this flexibility is left up to X4A9.1. It would be very desirable to provide for the substitution of , (comma) and . (period) in the shifted position of keys 73 and 74. The < and > , if required, could be placed outside the "Standard" area either on two keys or paired on a single key.

The scope of this standard should be limited to keyboards associated with devices whose primary function is to implement ASCII.

We believe that a complete arrangement as shown in Fig. 4 is required to provide the greatest benefit, however, an alternative would be to use the arrangement shown in Fig. 3 and make provisions under "Considerations" to assign low useage controls required for specific applications to the third shift position on the graphic key with the one bit rule.

Another acceptable variation would be to make "Standard" the assignment of keys 5 through 16, 25 through 35, 44 through 55, 65 through 76 and 81. The assignments to keys 3, 4, 17 and 18 would be recommended placements if these keys are used. Otherwise positions 3, 4, 17 and 18 would be available for other single purpose use.

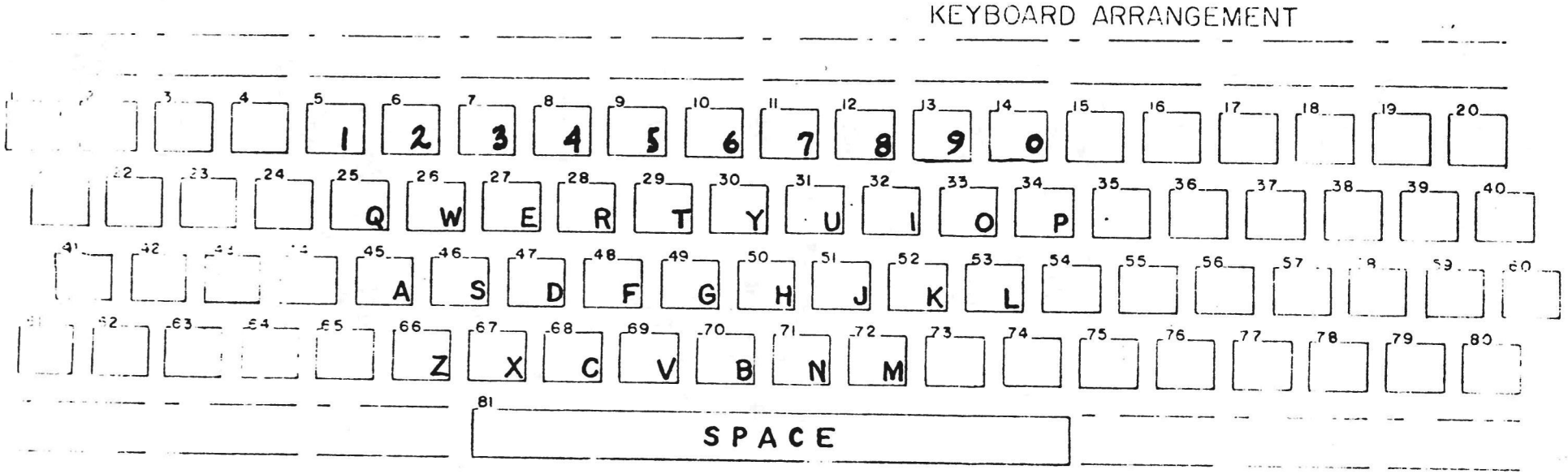

Fig. #1

37 Codes

Alpha - Numeric

36 Keys Plus Space

Mono Case Arrangement

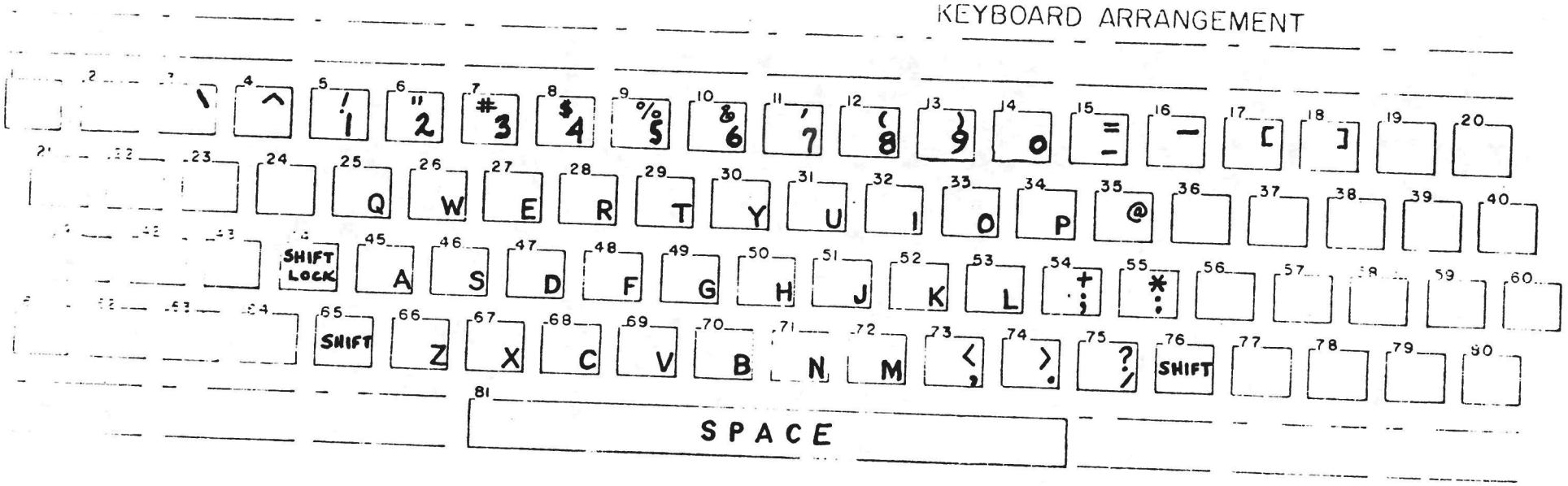

Fig. #2

64 Codes

Alpha - Numeric

48 Coded Keys Plus Space

ASCII Code Columns 2-3-4 & 5

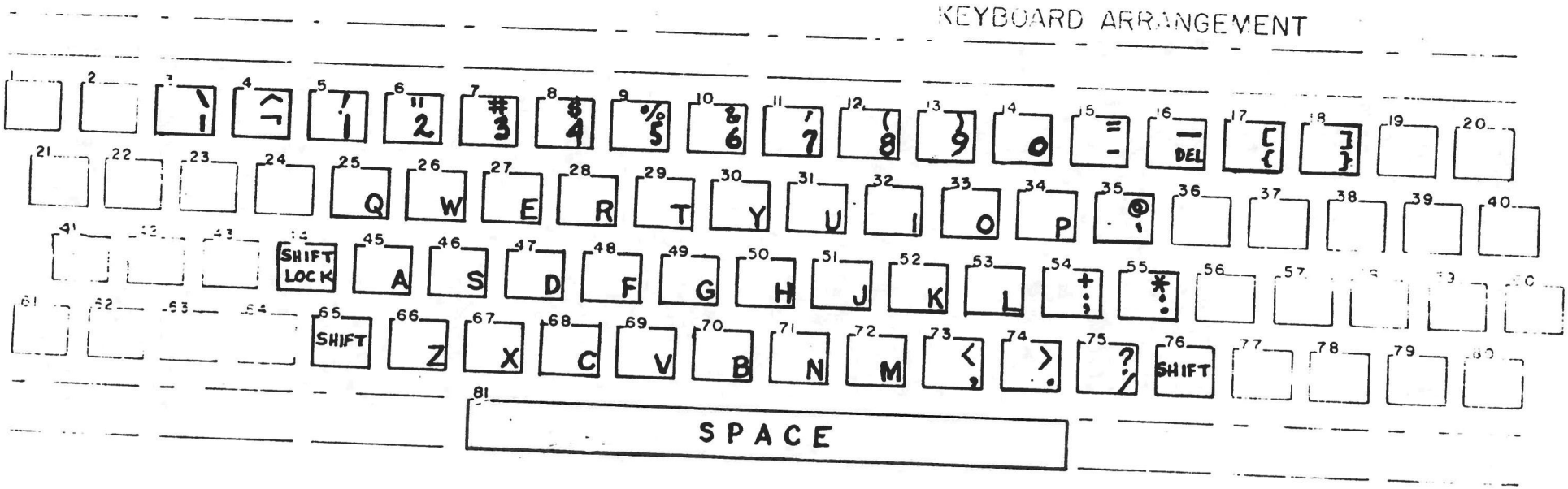

Fig. #3

96 Codes

Alpha - Numeric

48 Coded Keys Plus Space

ASCII Code Columns 2-3-4-5-6 & 7

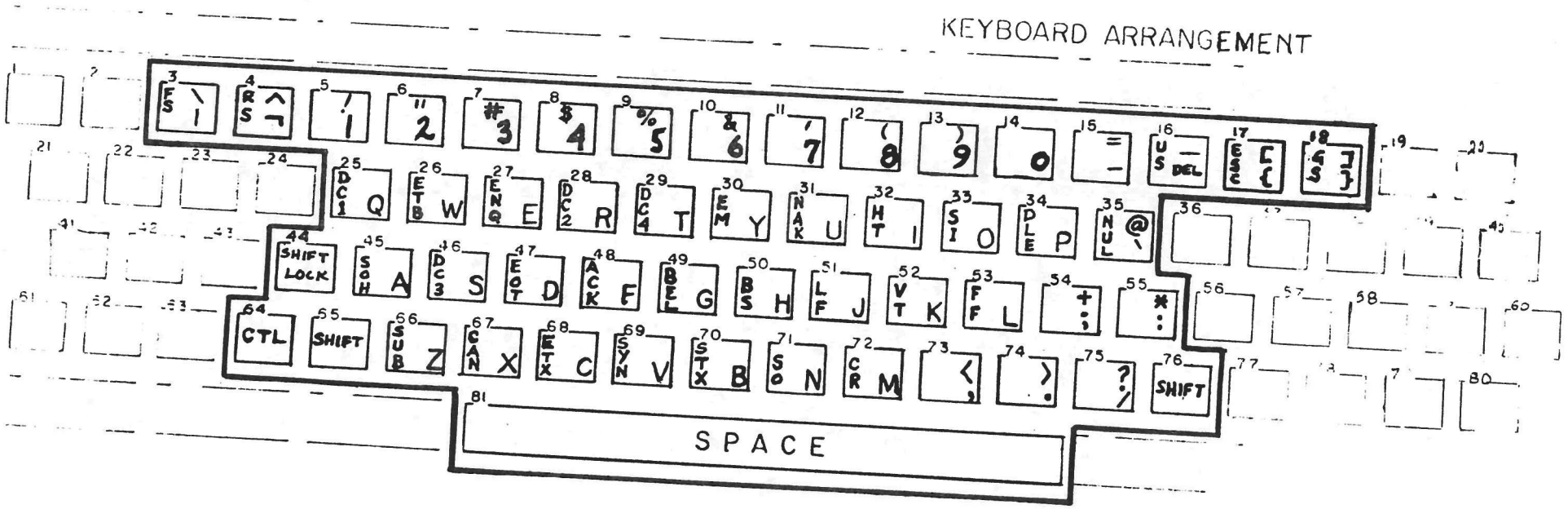

Fig. #4

128 Codes

Full ASCII-Alpha-Numeric With Controls

48 Coded Keys Plus Space

2. STANDARD CODE

Bits b_7 b_6 b_5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4 ↓	b_3 ↓	b_2 ↓	b_1 ↓	Row ↓ Column →	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

X3.2/384
May 20, 1966